Bass Beach, North Hampton

BEACH WATER QUALITY REPORT
SUMMER 2006

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NEW HAMPSHIRE DEPARTMENT OF Environmental Services

BACKGROUND

The New Hampshire Department of Environmental Services (DES) has operated a Public Beach Inspection Program, or Beach Program, for over 20 years. An established coastal beach monitoring program began in 1989 and the program continues to provide monitoring on a weekly basis. DES recognizes the health threat at public beaches. As a result, increased beach monitoring and bacteria source tracking have been implemented to further protect public health.

Coastal beaches are monitored for the presence of the fecal bacteria Enterococci. These fecal bacteria are present in the intestines of warm-blooded animals including humans. Fecal bacteria, when present in high concentrations and ingested, can commonly cause gastrointestinal illnesses such as nausea, vomiting and diarrhea. They are also known as indicator organisms, meaning their presence in water may indicate the presence of other potentially pathogenic organisms.

In October of 2000, the United States Environmental Protection Agency (EPA) signed into law the Beaches Environmental Assessment and Coastal Health (BEACH) Act. The BEACH Act is an amendment to the Clean Water Act, which authorizes the EPA to award grants to eligible states. The purpose of the BEACH Act is to reduce the risk of disease to users of the nation's recreational waters. BEACH Act grants provide support for development and implementation of monitoring and notification programs that help protect the public from exposure to pathogenic microorganisms in coastal recreation waters.

DES received grant funding in 2002 to develop and implement a beach monitoring and notification program consistent with EPA's performance criteria requirements published in the *National Beach Guidance and Required Performance Criteria for Grants* document (www.epa.gov/waterscience/beaches/grants). DES has successfully met all requirements and continues to expand the monitoring and notification program. In 2002, only nine coastal beaches were monitored, while in 2003 and 2004, 15 and 16 beaches respectively, were monitored on a routine basis. Fifteen beaches were sampled again in 2005 and 2006. In 2004, volunteers sampled Star Island beach, but circumstances did not allow for this cooperative effort in 2005 and 2006.

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Beach Description

Bass Beach is owned and operated by the Town of North Hampton. The beach is comprised of pebbles and has a total length of 1,220 feet. The beach is frequently used by residents for relaxing and surfing. There is one access point to the beach area from Route 1A (Figure 1). Lifeguards are not present during the summer and sanitary facilities are unavailable.

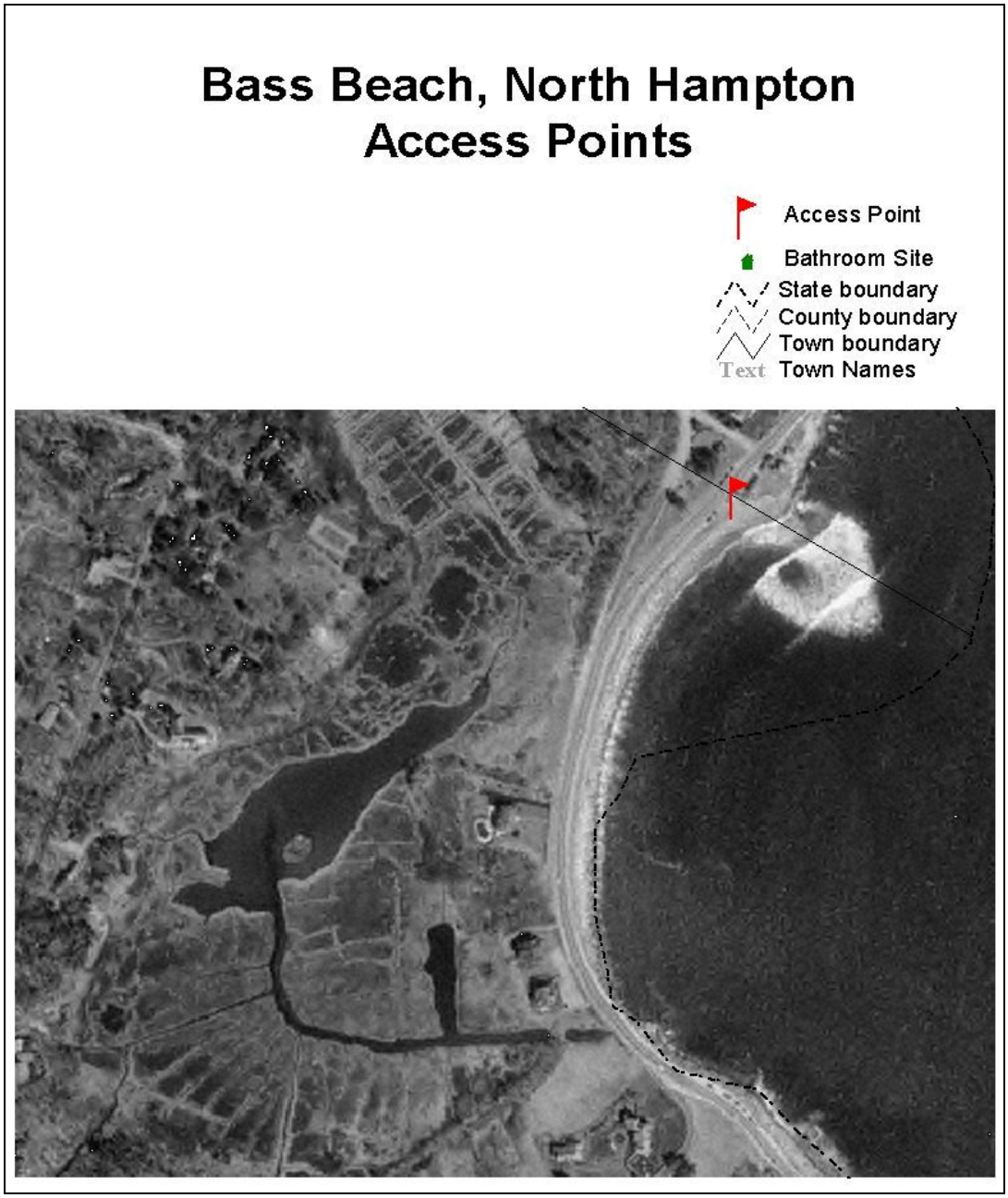

Figure 1. Bass Beach Access Points

Waterfowl and dogs are not frequently observed on the beach. During four inspections this year, the inspector noted that dogs had been present and on one inspection dog feces were observed on the beach. The town should consider enforcing an ordinance prohibiting dogs from beaches or supplying dog owners with refuse bags to clean up their pets' wastes.

Below is a brief description of the sampling stations at Bass Beach. All stations can be accessed via the entrance to the beach off Route 1A. Parking is also available on Causeway Road (Figure 2). The Unnamed Brook was added to the sampling program but sampled just once in 2005 (Table 4, Figure 4). There is historic data on this stream from the DES Coastal Nonpoint Inspection Program. The Unnamed Brook will permanently be sampled in 2007.

Table 1. Station Description

Description	Latitude	Longitude
Left sample station: located about 25 feet to the south of the entrance.	42˚ 58' 9.2245"	-70˚ 46' 15.5233
Center sample station: located about 50 feet to the south from the left sample station.	42˚ 58' 7.3096"	-70˚ 46' 17.5759"
Right sample station: located about 50 feet to the south from the center sample station.	42˚ 58' 4.2269"	-70˚ 46' 19.3622"
Chapel Brook sample: collected upstream of Route 1A, prior to the water entering the culvert that goes under the road toward the beach.	42˚ 57' 57"	-70˚ 46' 19"
Unnamed Brook sample: collected on the beach side of Route 1A. This drains Bass Beach Marsh (stream commonly called "Bass Beach Brook").	unavailable	unavailable

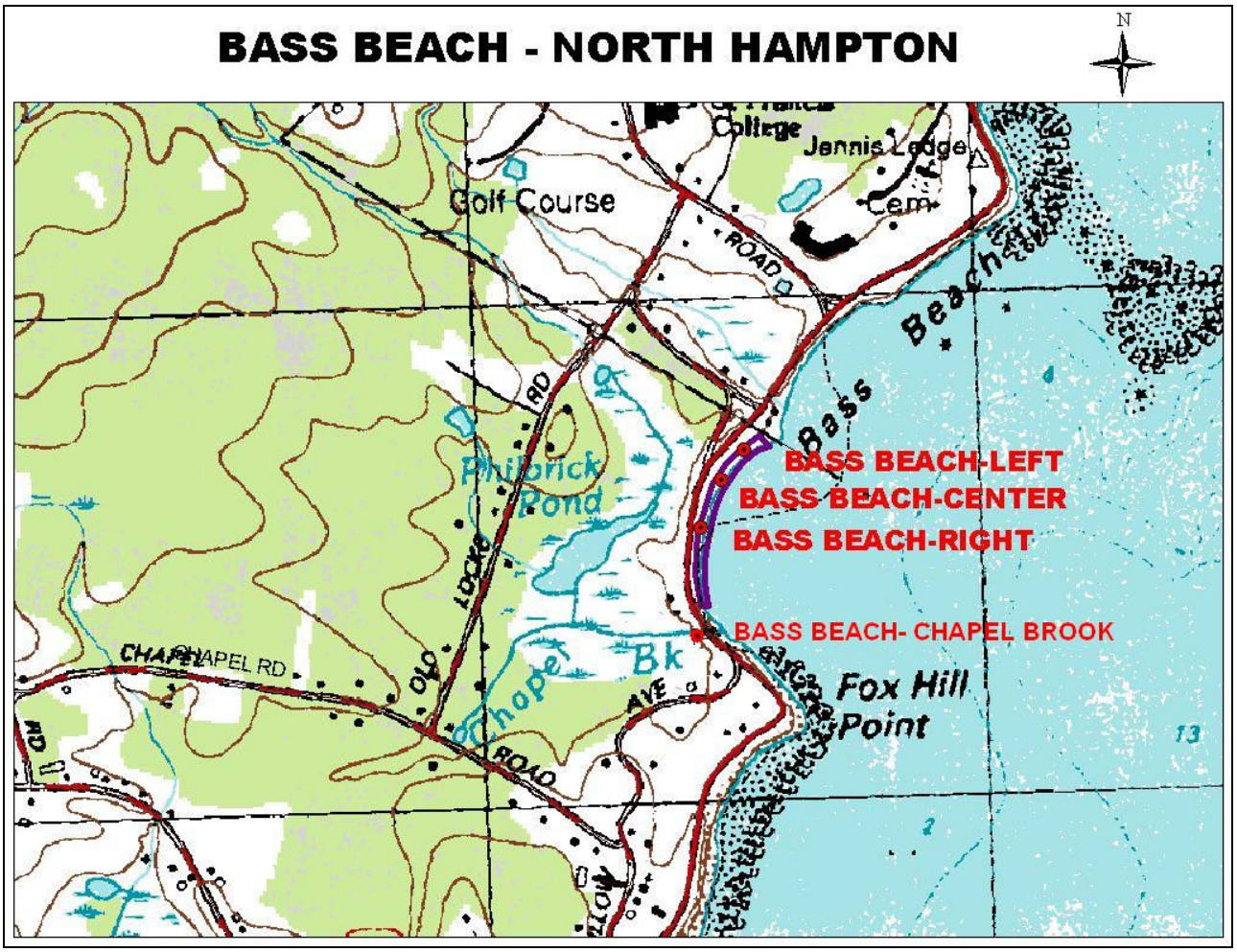

Figure 2. Map of Bass Beach

Tier Status and Sampling Frequency

The Beach Program developed a risk-based beach evaluation process and tiered monitoring approach and implemented this approach during the 2003 beach season. Beach evaluations are conducted annually to determine potential health threats to the public. Evaluations are based on several criteria in three main categories: beach history, microbial pathogen sources, and beach use. The evaluations for the 2006 season included a new criterion to assess beaches. Beaches are now assessed as impaired for bacteria. Impairments are based on the most recent version of the Consolidated Assessment and Listing Methodology (CALM) submitted to EPA by DES every two years. The CALM assesses beach units as impaired based on historical exceedances of both the single sample and geometric mean bacteria standards.

Based on these criteria, beaches were assigned a Tier I-Impaired, Tier I or Tier II status in 2006. Tier I-Impaired beaches are high priority and have an increased potential to affect public health, Tier I are medium priority, while Tier II are low priority beaches that have less potential to affect

public health. Beach sample frequency is based on the Tier statuses; Tier I-Impaired beaches were sampled twice per week, Tier I beaches were sampled once per week, and Tier II beaches were samples once every other week in 2006.

Bass Beach is a Tier I-Impaired beach. It was categorized as a Tier I-Impaired beach based on historical exceedances of the state bacteria standard. The beach ranking has changed since the system was implemented in 2002. Samples are collected twice per week at Bass Beach.

Water Quality

Beaches are monitored to ensure compliance with State Water Quality Standards. Marine waters are analyzed for the presence of the fecal bacteria Enterococci. Enterococci are known as indicator organisms, meaning their presence may indicate the presence of other pathogenic organisms. The state standard for Enterococci at public beaches is 104 counts/100 mL in one sample, or a geometric mean of 35 counts/100 mL in three samples collected over 60 days. Standard exceedances require the issuance and posting of a beach advisory. Beach advisories remain in effect until subsequent beach sampling indicates safe water quality conditions.

The number of samples collected at each beach is a function of beach length. Beaches less than 100 feet in length are sampled at left and right locations 1/3 of the distance from either end of the beach. Beaches greater than 100 feet in length are bracketed into thirds and sampled at left, center and right locations. Routine sample collection may be enhanced by sampling known or suspected pollution sources to the beach area. Storm event sampling may be conducted at beaches where wet-weather events are expected to affect beach water quality.

The 2006 season's weather can best be described as unpredictable. The sampling season began May 30. During the month of May, New Hampshire experienced flood conditions typical of a 100-year flood, while the months of June and July were wetter and warmer than normal, and August was unseasonably cool and dry. May experienced over 17 inches of rain setting a record high for the month, and over eight inches of rain fell during June (as recorded at Pease International Tradeport, Portsmouth, N.H.). Precipitation was recorded on 34 days of the 95 day sampling season. Twenty-two beach days (beach hours 9:00 a.m. to 5:00 p.m.) were directly affected by precipitation. There were a total of 26 routine inspections performed and 78 samples collected in 2006. Chapel Brook was also sampled 17 times this summer.

Table 2 and Figure 3 depict the Enterococci data from each sampling event in 2006. Overall, the summer 2006 Enterococci levels were moderate and within the state's standards for public beaches. A beach advisory was issued following elevated Enterococci levels at the left station on June 27. Rainfall totaling over 1.5" fell three days prior to the sampling event. Enterococci levels at the left sample station may be impacted by the Unnamed Brook discharge. Additional brook monitoring will occur during the 2007 season to assess bacteria loads. Subsequent samples collected at this beach were well below the state standard and the advisory was removed.

Table 2. Bass Beach Enterococci Data 2006

Sample Date	Station Name	Results (counts per 100 mL)
5/31/2006	Left	10
	Center	10
	Right	10
6/6/2006	Left	10
	Center	10
	Right	5
6/8/2006	Left	30
	Center	30
	Right	20
6/12/2006	Left	10
	Center	10
	Right	10
6/15/2006	Left	10
	Center	10
	Right	10
6/21/2006	Left	10
	Center	10
	Right	10
6/22/2006	Left	40
	Center	20
	Right	5
6/27/2006	Left	210
	Center	20
	Right	10
6/29/2006	Left	10
	Center	10
	Right	70
7/5/2006	Left	10
	Center	10
	Right	10
7/10/2006	Left	10
	Center	10
	Right	10
7/13/2006	Left	30
	Center	30
	Right	20
7/18/2006	Left	10
	Center	10
	Right	10
7/19/2006	Left	10
	Center	10
	Right	5

7/24/2006	Left	10
	Center	10
	Right	10
7/25/2006	Left	10
	Center	10
	Right	10
8/2/2006	Left	70
	Center	10
	Right	10
8/3/2006	Left	10
	Center	10
	Right	5
8/8/2006	Left	20
	Center	100
	Right	30
8/9/2006	Left	10
	Center	10
	Right	10
8/14/2006	Left	10
	Center	10
	Right	10
8/15/2006	Left	10
	Center	10
	Right	5
8/23/2006	Left	10
	Center	10
	Right	10
8/24/2006	Left	10
	Center	10
	Right	10
8/29/2006	Left	10
	Center	10
	Right	5
8/30/2006	Left	10
	Center	10
	Right	10

Figure 3 depicts Enterococci data in relation to the state standard for coastal beaches.

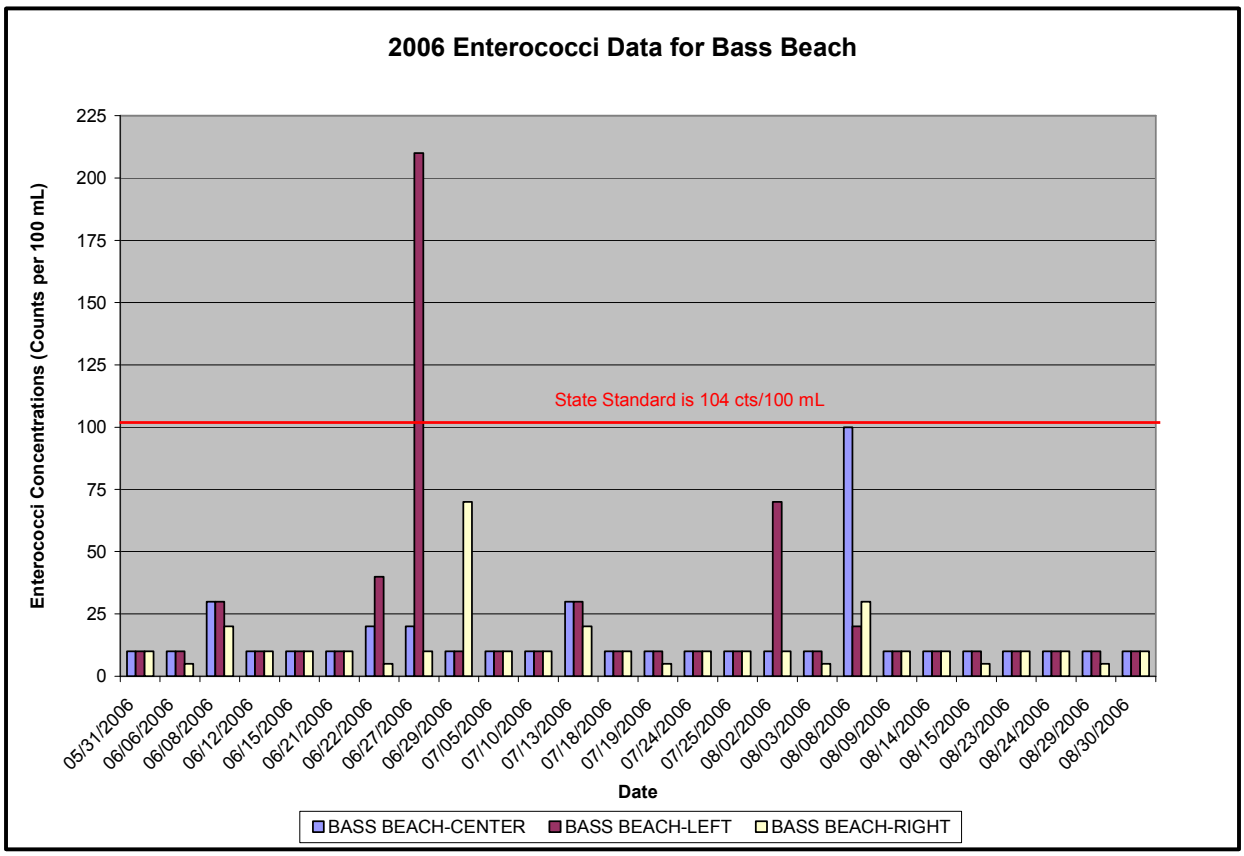

Figure 3. Bass Beach Enterococci Data 2006

Enterococci levels in Chapel Brook were variable this summer (Table 3 and Figure 4), with one large spike mid-summer. Heavy rainfall and increased runoff prior to the July 13 sample likely elevated Enterococci level of 2000 counts per 100 mL. The Chapel Brook subwatershed drainage, including the Philbrick Pond Marsh, contribute to the bacteria load. In addition to Enterococci, Chapel Brook was also monitored for *E. coli* (Figure 5). *E. coli* levels were relatively low with an increase on August 28 as a result of greater than 0.5 inches of rainfall prior to sample collection.

Table 3. Chapel Brook Enterococci Data 2006

Sample Date	Enterococci Results (counts per 100 mL)
05/17/2006	10
05/22/2006	20
5/25/2006	300
5/27/2006	10
5/31/2006	250
6/1/2006	30
6/7/2006	30
6/7/2006	270
6/7/2006	50
6/12/2006	80
6/15/2006	20
6/21/2006	10
6/27/2006	130
7/5/2006	170
7/13/2006	2000
7/18/2006	20
7/19/2006	70
7/25/2006	70
8/2/2006	20
8/3/2006	210
8/14/2006	10
8/15/2006	130
8/24/2006	90
8/29/2006	80
8/30/2006	50

Figure 4 depicts the 2006 Enterococci data from Chapel Brook.

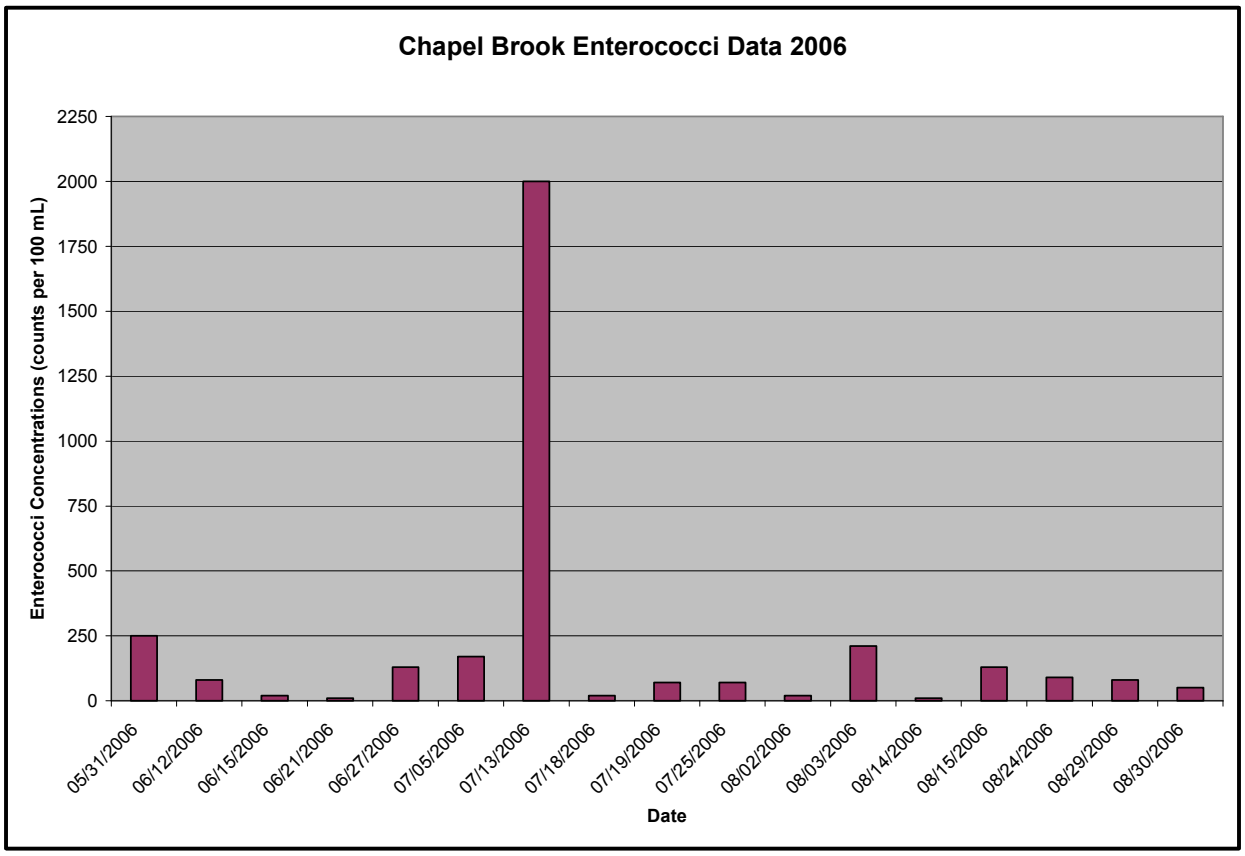

Figure 4. Chapel Brook Enterococci Data 2006

Figure 5 depicts *E. coli* data collected from Chapel Brook.

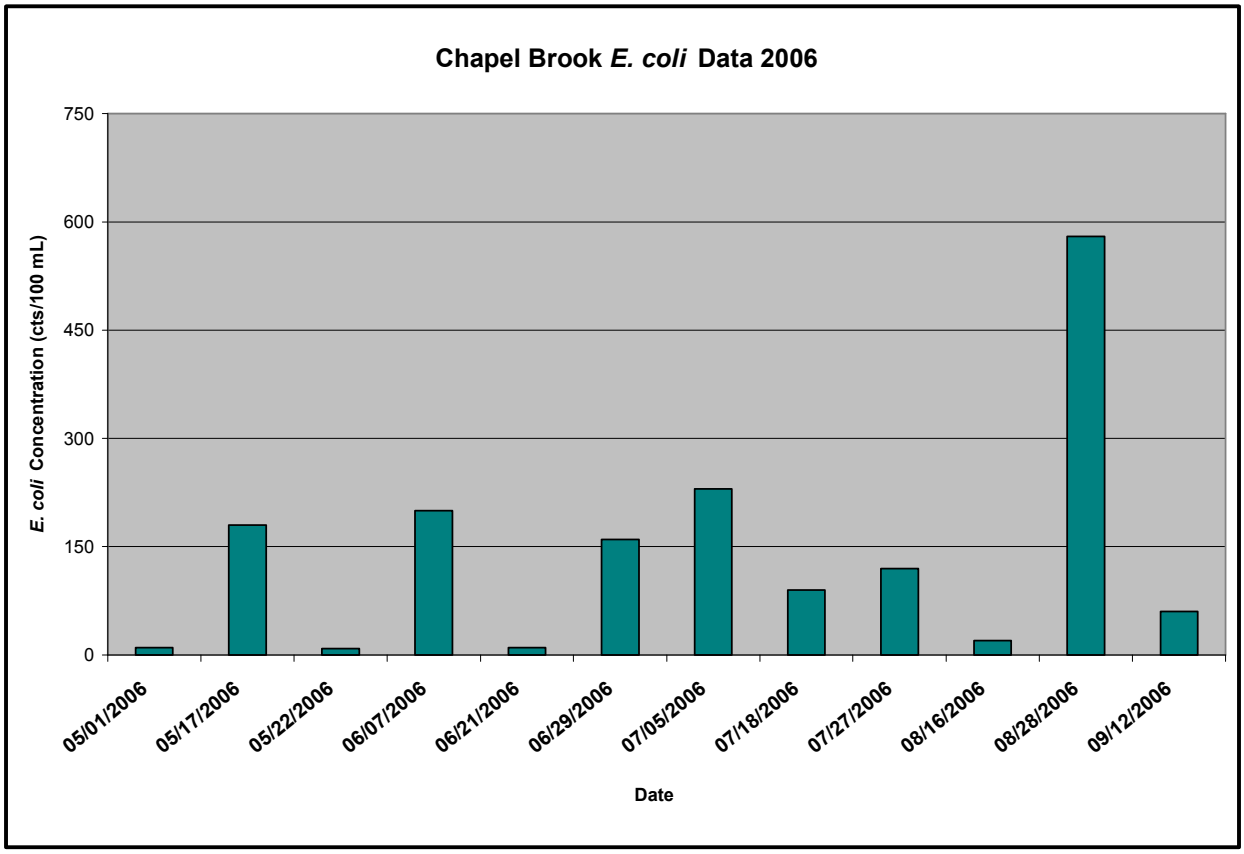

Figure 5. Chapel Brook *E. coli* Data 2006

Special Studies

Chapel Brook was the site of a water quality investigation in 2006 to document any contributions to beach bacteria levels. Four watershed sampling stations were established to pinpoint bacterial "hot spots". Chapel Brook is within the watershed of the Bass Beach/Philbrick Pond salt marsh located along the North Hampton/Rye border. Chapel Brook is the final discharge of the salt marsh. Sites along Chapel Brook and the salt marsh were selected for further investigation (Figure 6). Station descriptions are included in Table 4. Study results indicate that the main bacteria sources to the Chapel Brook system are a pond located upstream (Chapel Brook-Pond), a tributary to the pond (Chapel Rd.-Stream), and a stream draining a residential area bordering the Golf Course (16 Old Locke Rd.) (Figure 7 and Table 5).

Table 4. Chapel Brook Investigation Station Descriptions

Station ID	Station Name	Station Description	Station Directions
BCHBASNHMCHAP	Bass Beach Chapel Brook	Upstream of culvert along Rt. 1A	101E to exit 12 to Rt. 1A North. Chapel Brook is on the left before Bass Beach.
RIVCHAPNHM16OLR	Chapel Brook 16 Old Locke Rd.	Small stream that discharges under Old Locke Rd. into Philbrick Pond Marsh. The stream runs next to house #16.	101E to exit 12 to Rt. 1A North. Left onto Willow Ave., left onto Chapel Rd., right onto Old Locke Rd. house #16 is on the left.
RIVCHAPNHMCHR	Chapel Brook Stream on Chapel Rd.	Stream flowing from wooded area into a private pond. Stream flows under Chapel Rd., sample collected on left side of rd.	101E to exit 12 to Rt. 1A North. Left onto Willow Ave., left onto Chapel Rd. The stream is on the left before you get to Old Locke Rd.
RIVCHAPNHMPNH	Chapel Brook Pond	Outlet from a private pond at a residence on the corner of Chapel Rd. and Old Locke Rd.	101E to exit 12 to Rt. 1A North. Left onto Willow Ave., left onto Chapel Rd., the house is on the right at the corner of Chapel Rd. and Old Locke Rd.
RIVCHAPNHMGC	Chapel Brook Golf Course	Discharge from a detention pond at Abenaqui CC. Discharges under Old Locke Rd. and eventually into Philbrick Pond Marsh.	101E to exit 12 to Rt. 1A North. Left onto Willow Ave., left onto Chapel Rd., right onto Old Locke Rd. Golf course is on left towards the end of the road and detention pond is on the left.

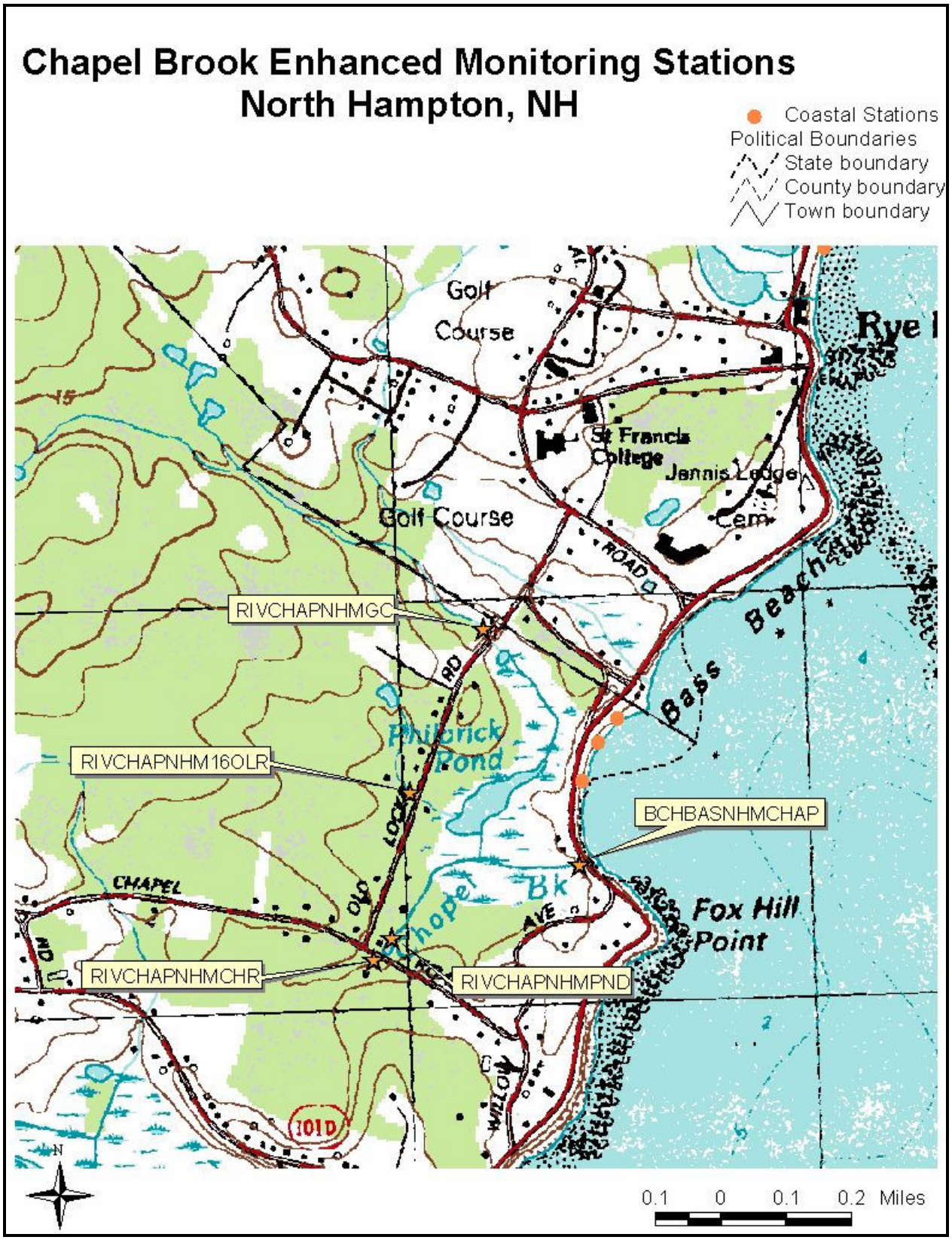

Figure 6. Chapel Brook Investigation Monitoring Stations

Figure 7 depicts the Chapel Brook Watershed Investigation *E. coli* data.

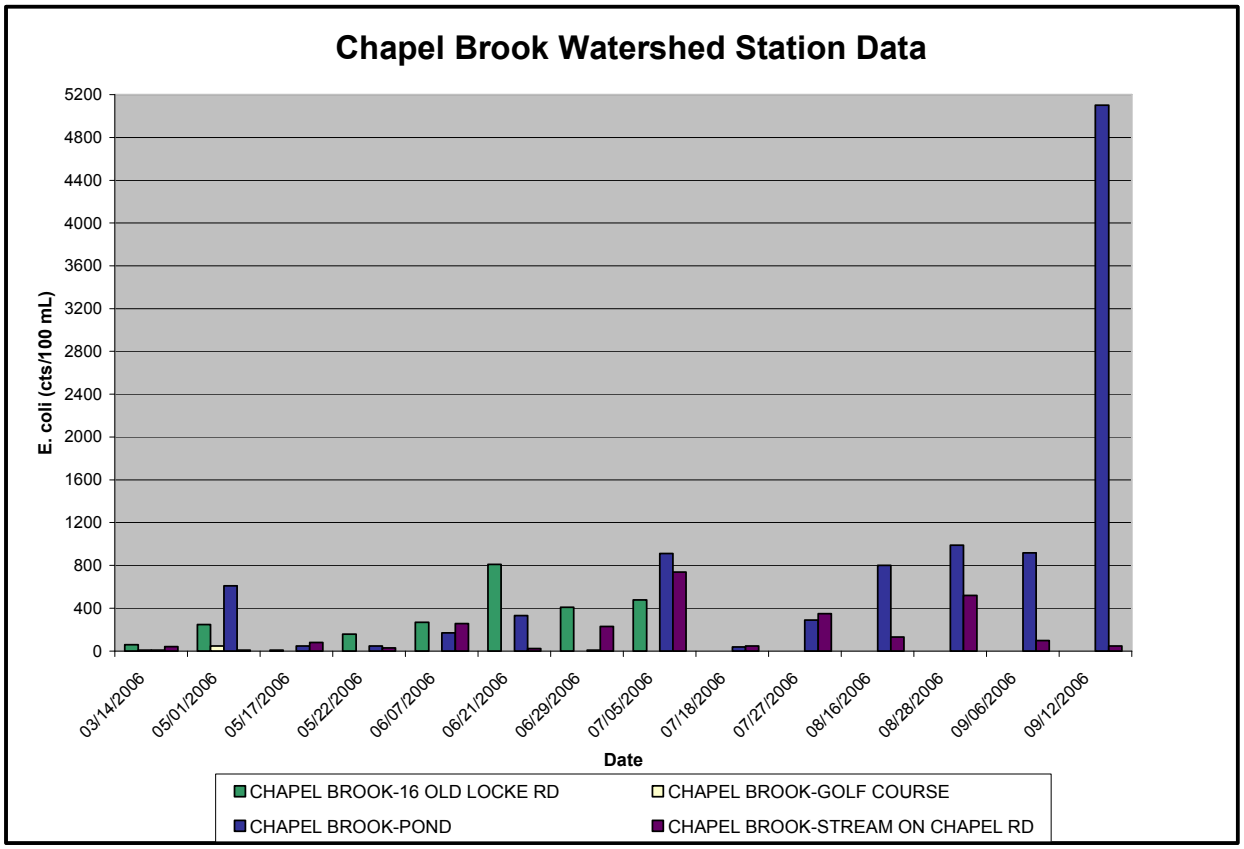

Figure 7. Chapel Brook Watershed Station E. coli Data

Table 5. Chapel Brook Watershed Station E. coli Data

Station Name	Date	E. coli Counts
16 OLD LOCKE RD (RIVCHAPNHM16OLR)	03/14/2006	60
16 OLD LOCKE RD (RIVCHAPNHM16OLR)	05/01/2006	250
16 OLD LOCKE RD (RIVCHAPNHM16OLR)	05/22/2006	10
16 OLD LOCKE RD (RIVCHAPNHM16OLR)	06/07/2006	160
16 OLD LOCKE RD (RIVCHAPNHM16OLR)	06/29/2006	270
16 OLD LOCKE RD (RIVCHAPNHM16OLR)	07/18/2006	810
16 OLD LOCKE RD (RIVCHAPNHM16OLR)	08/28/2006	410
16 OLD LOCKE RD (RIVCHAPNHM16OLR)	09/06/2006	480
GOLF COURSE (RIVCHAPNHMGC)	05/22/2006	10
GOLF COURSE (RIVCHAPNHMGC)	06/07/2006	46
POND (RIVCHAPNHCPND)	03/14/2006	10
POND (RIVCHAPNHCPND)	05/01/2006	610
POND (RIVCHAPNHCPND)	05/17/2006	50
POND (RIVCHAPNHCPND)	05/22/2006	50
POND (RIVCHAPNHCPND)	06/07/2006	170
POND (RIVCHAPNHCPND)	06/21/2006	330
POND (RIVCHAPNHCPND)	06/29/2006	10
POND (RIVCHAPNHCPND)	07/05/2006	910
POND (RIVCHAPNHCPND)	07/18/2006	38
POND (RIVCHAPNHCPND)	07/27/2006	290
POND (RIVCHAPNHCPND)	08/16/2006	800
POND (RIVCHAPNHCPND)	08/28/2006	990
POND (RIVCHAPNHCPND)	09/06/2006	920
POND (RIVCHAPNHCPND)	09/12/2006	5100
STREAM ON CHAPEL RD (RIVCHAPNHMCHR)	03/14/2006	40
STREAM ON CHAPEL RD (RIVCHAPNHMCHR)	05/01/2006	10
STREAM ON CHAPEL RD (RIVCHAPNHMCHR)	05/17/2006	80
STREAM ON CHAPEL RD (RIVCHAPNHMCHR)	05/22/2006	30
STREAM ON CHAPEL RD (RIVCHAPNHMCHR)	06/07/2006	258
STREAM ON CHAPEL RD (RIVCHAPNHMCHR)	06/21/2006	24
STREAM ON CHAPEL RD (RIVCHAPNHMCHR)	06/29/2006	230
STREAM ON CHAPEL RD (RIVCHAPNHMCHR)	07/05/2006	740
STREAM ON CHAPEL RD (RIVCHAPNHMCHR)	07/18/2006	48
STREAM ON CHAPEL RD (RIVCHAPNHMCHR)	07/27/2006	350
STREAM ON CHAPEL RD (RIVCHAPNHMCHR)	08/16/2006	130
STREAM ON CHAPEL RD (RIVCHAPNHMCHR)	08/28/2006	520
STREAM ON CHAPEL RD (RIVCHAPNHMCHR)	09/06/2006	100
STREAM ON CHAPEL RD (RIVCHAPNHMCHR)	09/12/2006	50

Areas of Concern

Chapel Brook was initially identified as a pollution source to the Atlantic Coast by the DES Shellfish Program's sanitary surveys. Chapel Brook was then added to the Beach Program's ambient monitoring program in 2004 to assess potential impacts to Bass Beach. In 2003, Chapel Brook was part of a microbial source tracking study to identify bacteria sources. The results of that study indicated that wild animals and humans contributed to 22 and 19 percent, respectively, of the isolates identified. The 2006 watershed investigation identified the areas of concern in the Chapel Brook watershed. This data will further be compiled in a final report that will be submitted to town officials. The report will recommend further remediation actions that will lead to a decrease in bacteria sources.

Bass Beach Brook (or Unnamed Brook) is another area of concern at Bass Beach. The brook was identified as a pollution sources contributing to elevated bacteria levels by the DES Shellfish Program and Coastal Investigations. This brook was subject to further investigations by the Coastal Watershed Investigator to identify bacterial "hot spots". The bacteria source is likely a failed septic system. The Town of Rye was notified and remediation actions recommended. As mentioned previously, Bass Beach Brook will be permanently added to the Bass Beach monitoring program in 2007.

Thoughts for the Future

- The Town of North Hampton, local businesses, or school group should consider joining DES's Adopt-a-Beach Program. The program would consist of beach clean-ups and water quality monitoring. DES would conduct training sessions and participate in education and outreach activities for the community. If you are interested, please contact Alicia Carlson at (603) 271-0698 or acarlson@des.state.nh.us.

- The beach management should install dog waste receptacles and bags to reduce the amount of fecal contamination to the beach. If interested, please contact Sara Sumner. The Beach Program has funds available to supply towns with pet waste receptacles.

- The Town of North Hampton should implement remediation activities along Chapel Brook as recommended by the Chapel Brook Watershed Investigation Final Report.

Appendix A

Special Topic 2006

Rapid Assessment Methodology for the Detection of Microbiological Indicators

To assess beach water quality, the Department of Environmental Services (DES) monitors fecal indicator bacteria levels at coastal beaches on a routine basis. Unfortunately, results from sample analysis can take anywhere from 24 to 48 hours. Because it takes at least 24 hours to receive results, beach managers and the public are not informed of water quality problems until after the public may have been exposed. This is an issue facing beach officials throughout the world, and is a priority of the US Environmental Protection Agency (EPA). The EPA, universities and private entities are researching rapid assessment methods to enumerate bacteria and viruses. These methods will allow beach officials to post advisories on the same day water quality is impaired, thus, better protecting public health. There are three different rapid assessment method technologies available: Molecular surface recognition, nucleic acid detection and enzyme/substrate based methods. All rapid assessment methods will take less than two hours to obtain results.

Molecular surface recognition methods capture and/or label the target bacterium by binding to molecular structures on the exterior surface or in its genetic material. Analyses of coastal beach water samples currently employ culture-based methods for the detection of Enterococci bacteria, an indicator for fecal pollution in marine water. The quickest culture-based method takes up to 24 hours to provide results. Now, a new method is being developed to enumerate Enterococci. This new method uses Transcription-Mediated Amplification (TMA) with a fluorescently-labeled probe to amplify a specific region of Enterococci ribosomal RNA (rRNA).

The TMA rapid assessment method is currently being tested in Southern California. Method development is moving quickly and will likely come to execution within five years. Method cost is a significant reason the new technology is not currently employed. Once this procedure is widely and routinely accepted, the expenses should lower. This rapid assessment method is very beneficial as it will allow beach managers to take immediate action towards protecting the public from waterborne pathogen exposure on the same day water is sampled.

Another rapid assessment method being developed for fecal indicator detection is Quantitative Polymerase Chain Reaction (QPCR). QPCR is a nucleic acid detection method that targets genetic material of bacteria, viruses or protozoan indicators. QPCR is used to test for both *E. coli* and Enterococci. Results can be obtained from this method on an average of two hours after sampling. This method has demonstrated 85-90 percent agreement with existing routine methods. QPCR can be used to detect other water quality indicators such as *Bacteroides thetaiotamicron* and human enterovirus. Studies indicate that ratios of *B. thetaiotamicron* may provide useful information as to fecal contamination sources.

The final rapid assessment technology methods available are the enzyme/substrate based methods. These methods pair chromogenic or fluorogenic substrate methods already widely used with advanced optical or electrical detectors. These methods are directed at reducing the incubation periods of current membrane filtration methods. Some of these methods measure excitation and absorbance of the fluorescent metabolite of Enterococci using a fluorometer to speed the detection rate. A popular type of enzyme/substrate method is called Dual-Wavelength Fluorimetry (DWF).

These rapid assessments methods are currently being tested for accuracy, sensitivity and efficiency. Research indicates that these new methods will be made available within the next five years. Once these technologies are made available and laboratories adopt the methods, beach management will have a new tool to better protect public health. With assistance from EPA Beach Grants, New Hampshire will be proactive in employing accepted methods.